

Rapid Detection of Methyl Tert-butyl Ether (MTBE) in the Groundwater using Direct Sampling Ion Trap Mass Spectrometer

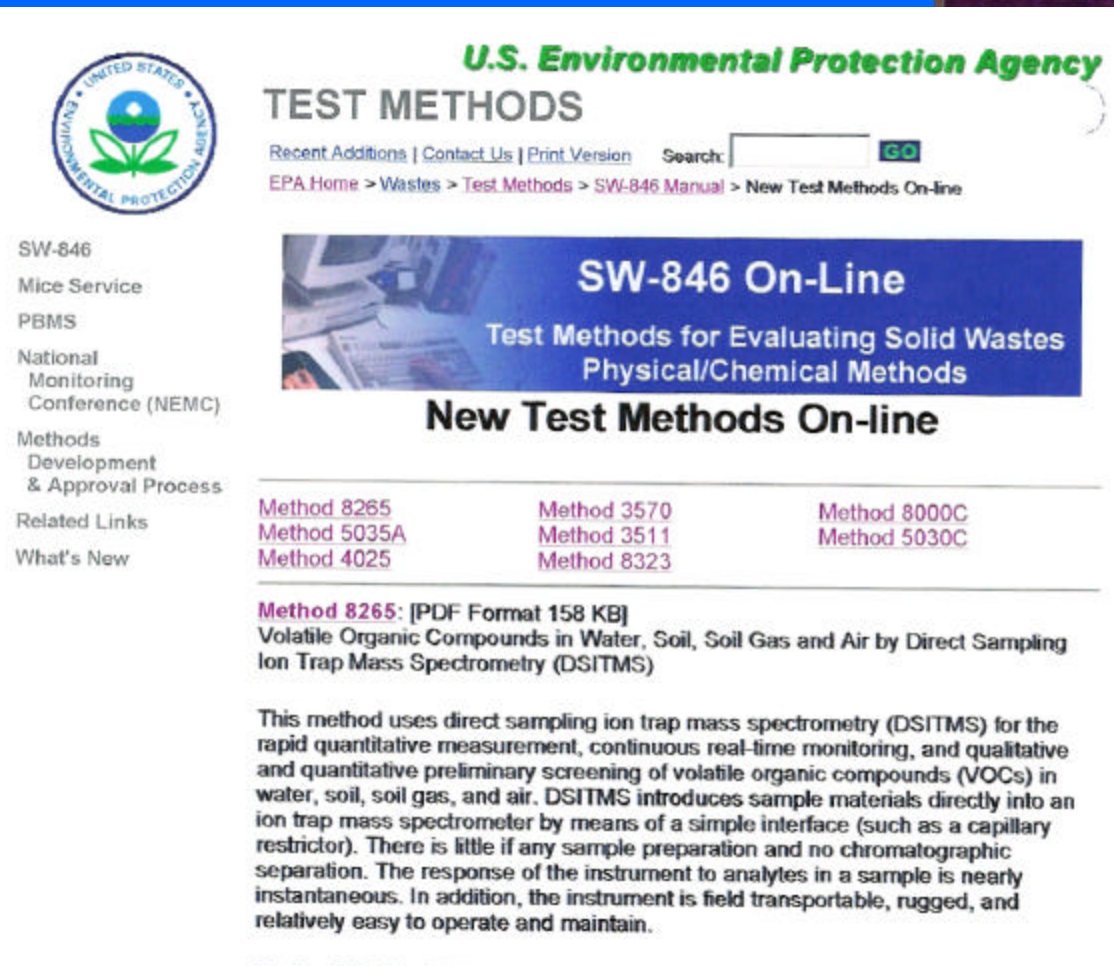
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DSITMS APPROVED BY US EPA

SW 846 Method 8265



U.S. Environmental Protection Agency

TEST METHODS

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SW-846 On-Line

Test Methods for Evaluating Solid Wastes
Physical/Chemical Methods

New Test Methods On-line

Method 8265	Method 3570	Method 8000C
Method 5035A	Method 3511	Method 5030C
Method 4025	Method 8323	

Method 8265: [PDF Format 158 KB]
Volatile Organic Compounds in Water, Soil, Soil Gas and Air by Direct Sampling Ion Trap Mass Spectrometry (DSITMS)

This method uses direct sampling ion trap mass spectrometry (DSITMS) for the rapid quantitative measurement, continuous real-time monitoring, and qualitative and quantitative preliminary screening of volatile organic compounds (VOCs) in water, soil, soil gas, and air. DSITMS introduces sample materials directly into an ion trap mass spectrometer by means of a simple interface (such as a capillary restrictor). There is little if any sample preparation and no chromatographic separation. The response of the instrument to analytes in a sample is nearly instantaneous. In addition, the instrument is field transportable, rugged, and relatively easy to operate and maintain.



<http://www.epa.gov/epaoswer/hazwaste/test/index.htm>

Triad Approach

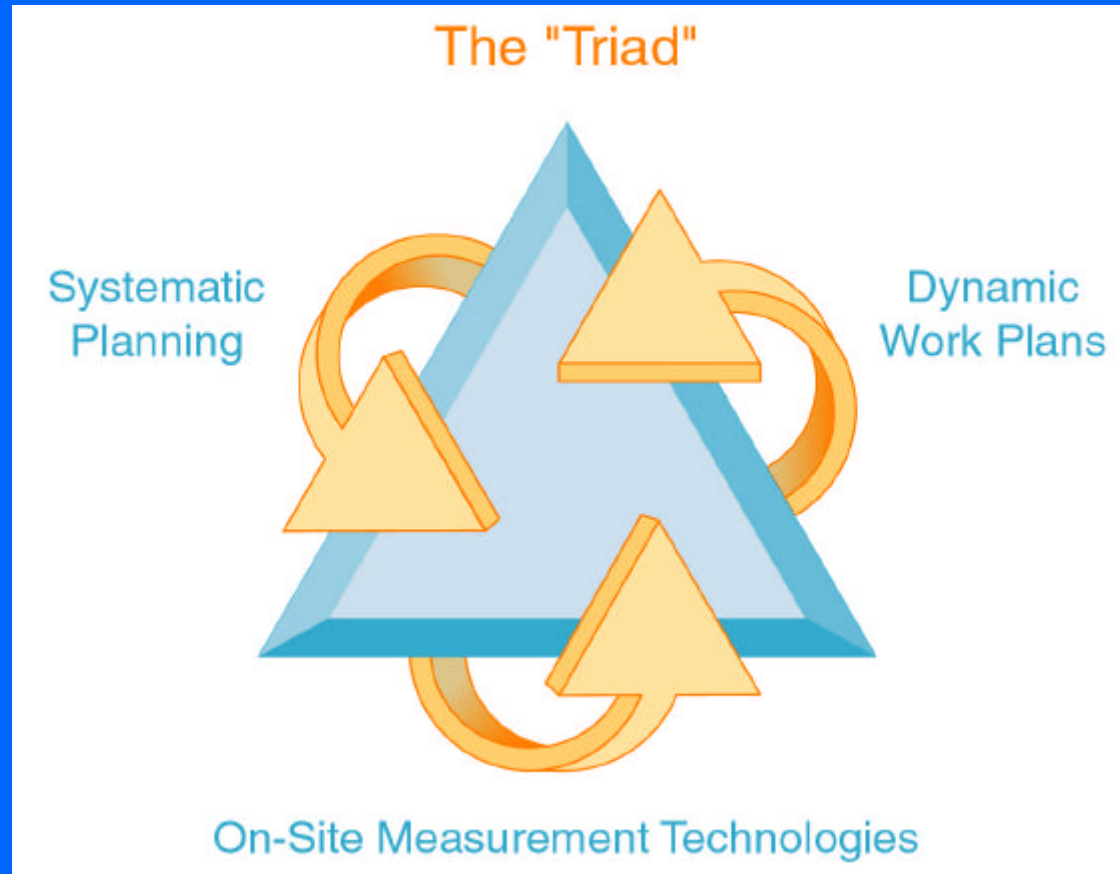
DQO process ideal for
Systematic Planning

Numerous field
analytical methods
available

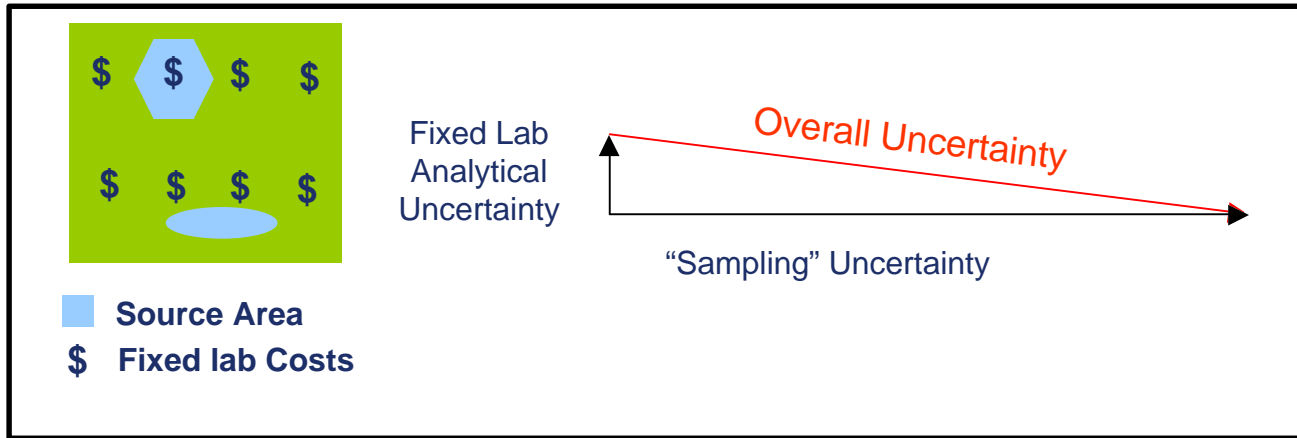
Data quality adequate
to support decisions

Effective data manage
largest uncertainty:

Contaminant heterogeneity and sample representativeness

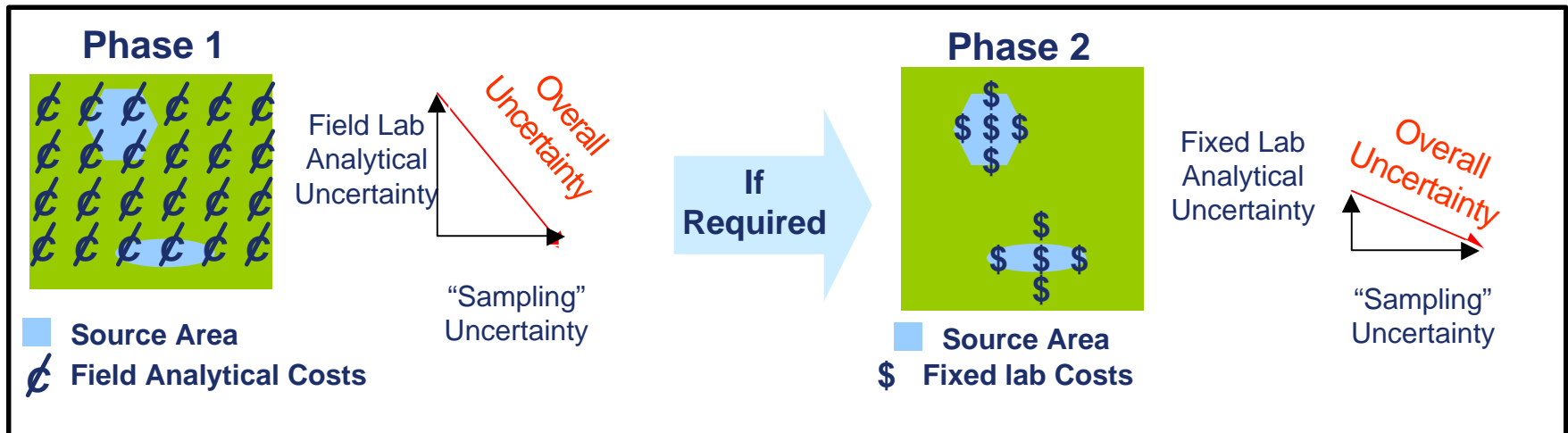


Uncertainty Management



Conventional Approach

Triad Approach



Saturn 2000 based DSITMS



40 mL Vial Sparge Interface, EPA Method 8265

Very rapid analyses, 2-3 min/sample
Wide dynamic range , low carry over

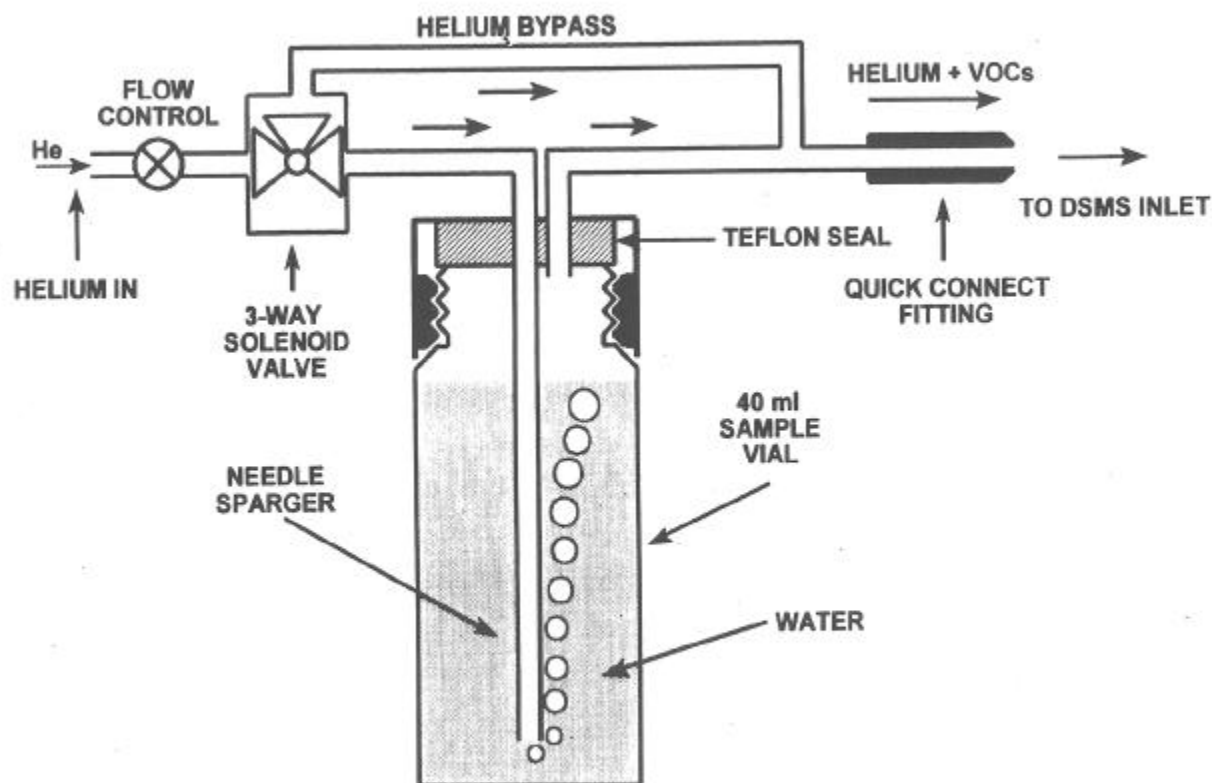
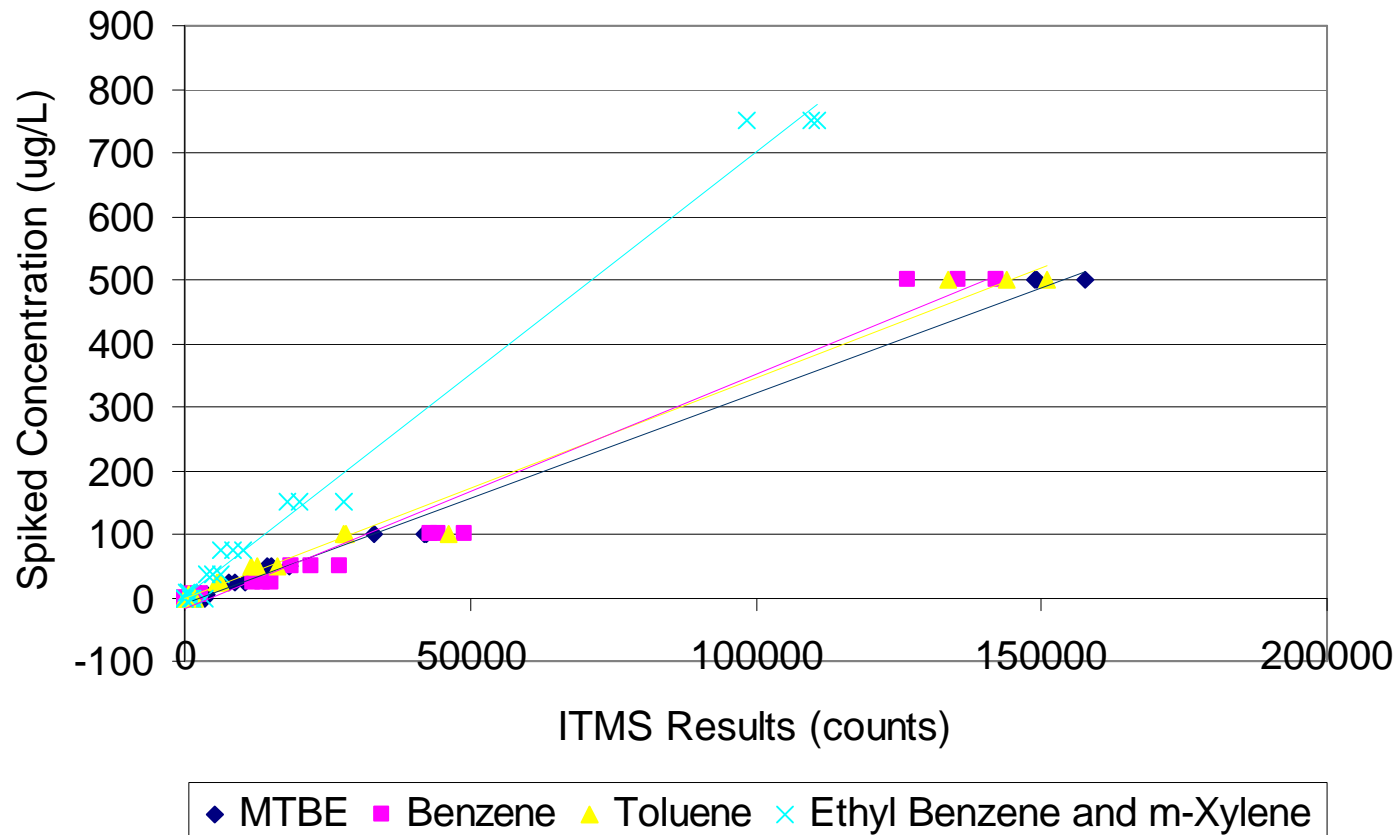


Figure 3 Purge module for analysis of VOCs in water. This apparatus is intended for use in conjunction with standard 40 ml VOA sample vials

Typical calibration curves for DSITMS using EPA Method 8265 for GW analysis

Naval Training Center Gas Station, San Diego, CA
ITMS - Vial Sparge Calibration, 25 March 2000

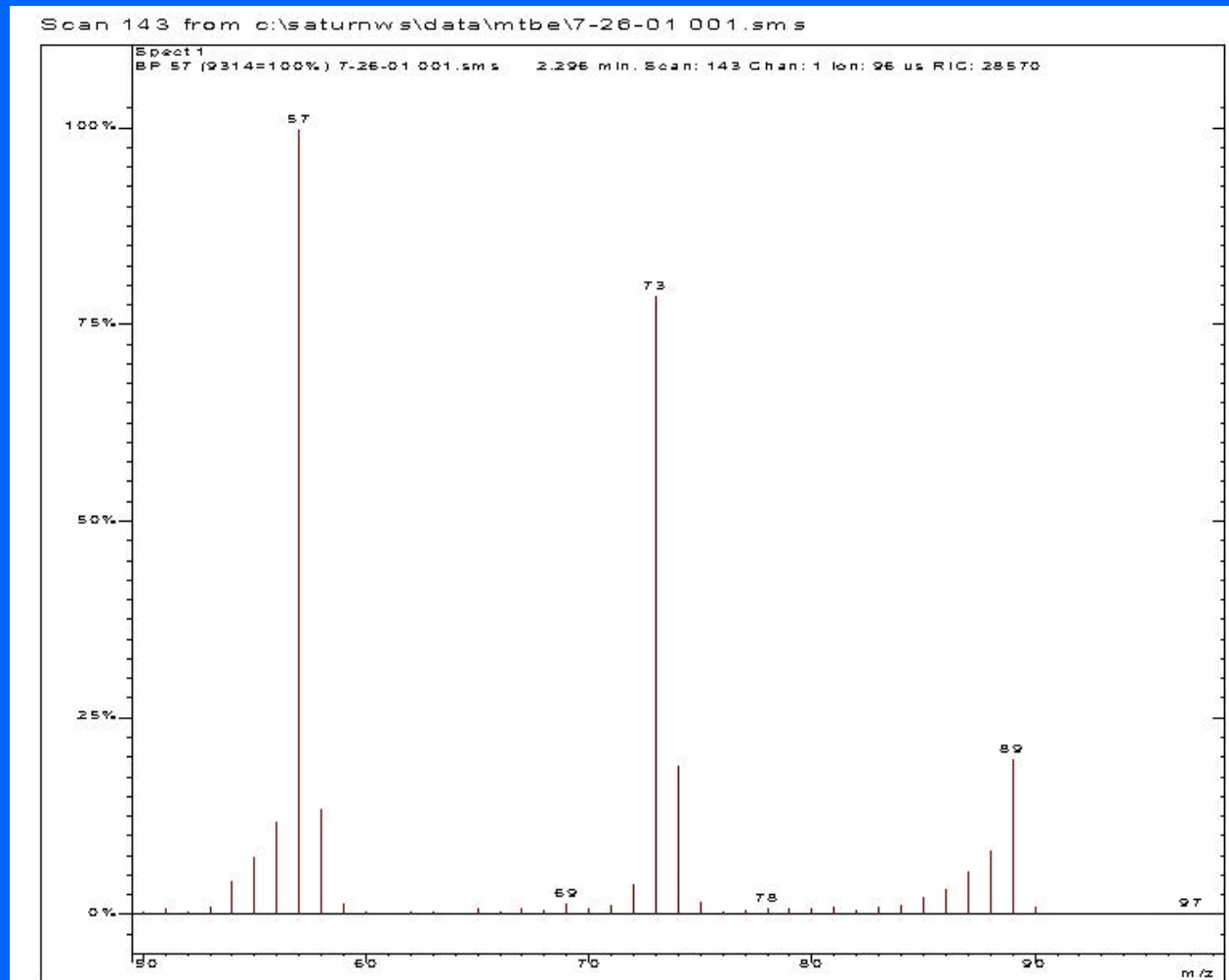


Validation results for Naval Submarine Base NEX San Diego, CA April 2000

Table 3 - ITMS-Vial Sparge vs. EPA Method 8260B and 8021B

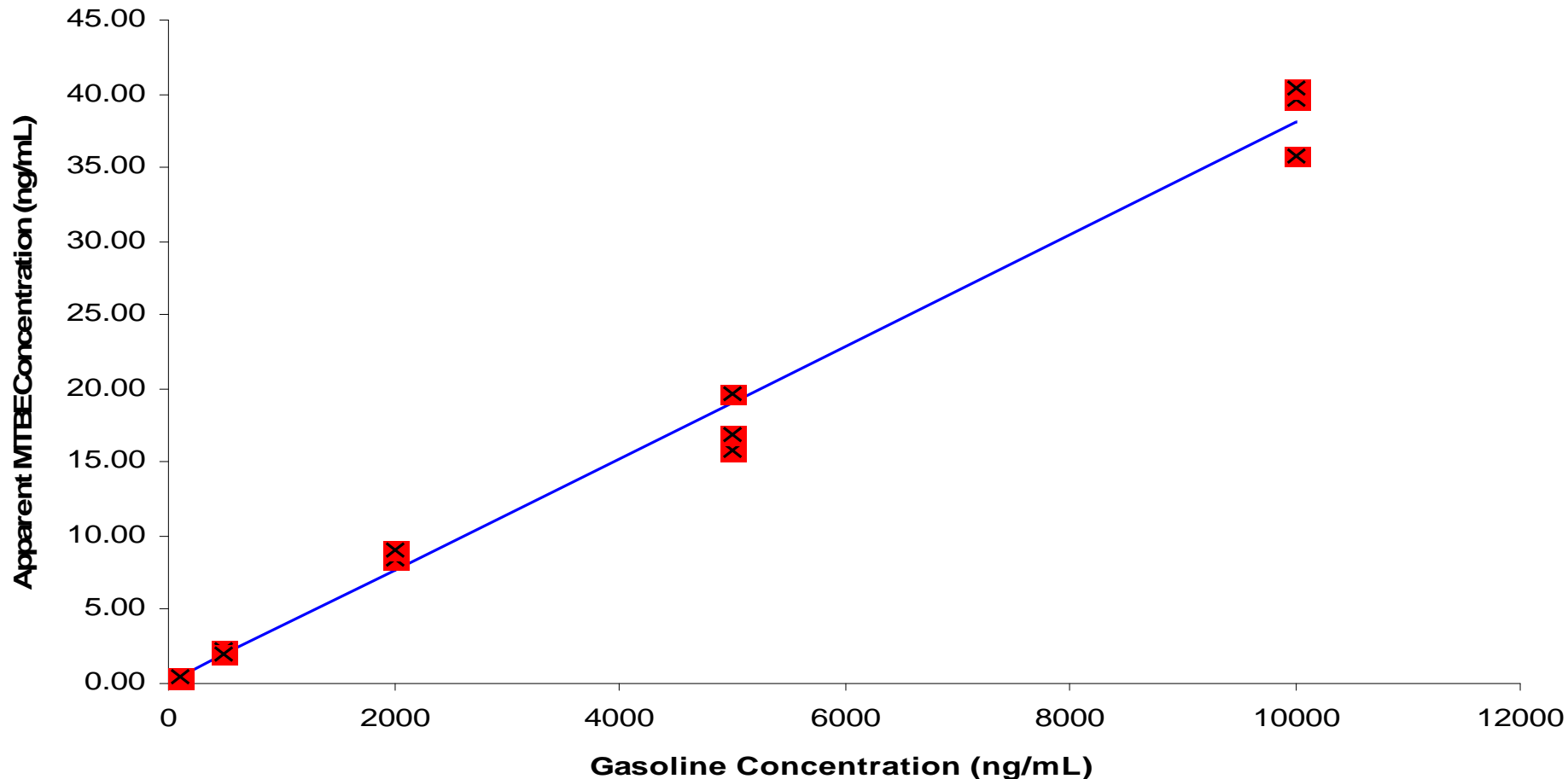
	MTBE		benzene		toluene		xylenes ethyl-benzene			
method	ITMS	8260B	ITMS	8260B	ITMS	8260B	ITMS	8260B	dilution factor	
reporting limit	2	5	1	5	1	5	1	10	ITMS	8260B
sbsd-nex-02	17779	2400	3304	950	8715	6300	43128	32600	100	20
sbsd-nex-07	6	nd	nd	nd	nd	nd	nd	nd	1	1
sbsd-nex-08	4	nd	nd	nd	nd	nd	nd	nd	1	1
sbsd-nex-11	nd	nd	nd	nd	nd	nd	nd	nd	1	1
sbsd-nex-12	65	90	nd	nd	nd	nd	nd	nd	1	1
method	ITMS	8021B	ITMS	8021B	ITMS	8021B	ITMS	8021B		
MW-1	nd	nd	nd	nd	nd	nd	nd	nd	1	1
MW-2(B)	270	350	nd	nd	nd	nd	nd	nd	1	10
MW-3	nd	nd	nd	nd	nd	nd	nd	nd	1	1
MW-4	nd	nd	nd	nd	nd	nd	nd	nd	1	1
MW-5	nd	nd	nd	nd	nd	nd	nd	nd	1	1
MW-6	3	1	nd	nd	nd	nd	nd	nd	1	1
MW-7(NP)	11815	5700	nd	nd	nd	nd	nd	nd	100	250
MW-7(P)	12394	5600	3	nd	10	nd	nd	nd	100	250
MW-8	20	18	nd	nd	nd	nd	nd	nd	1	1
MW-9	17	65	nd	nd	nd	nd	nd	nd	1	1

**MTBE detection by EPA Method 8265 using Direct
Sampling Ion Trap Mass Spectrometry (DSITMS)
Electron impact ionization using m/e 73 for
quantification, detection limits at 1-2 ug/L with 40 mL vial
sparge interface**

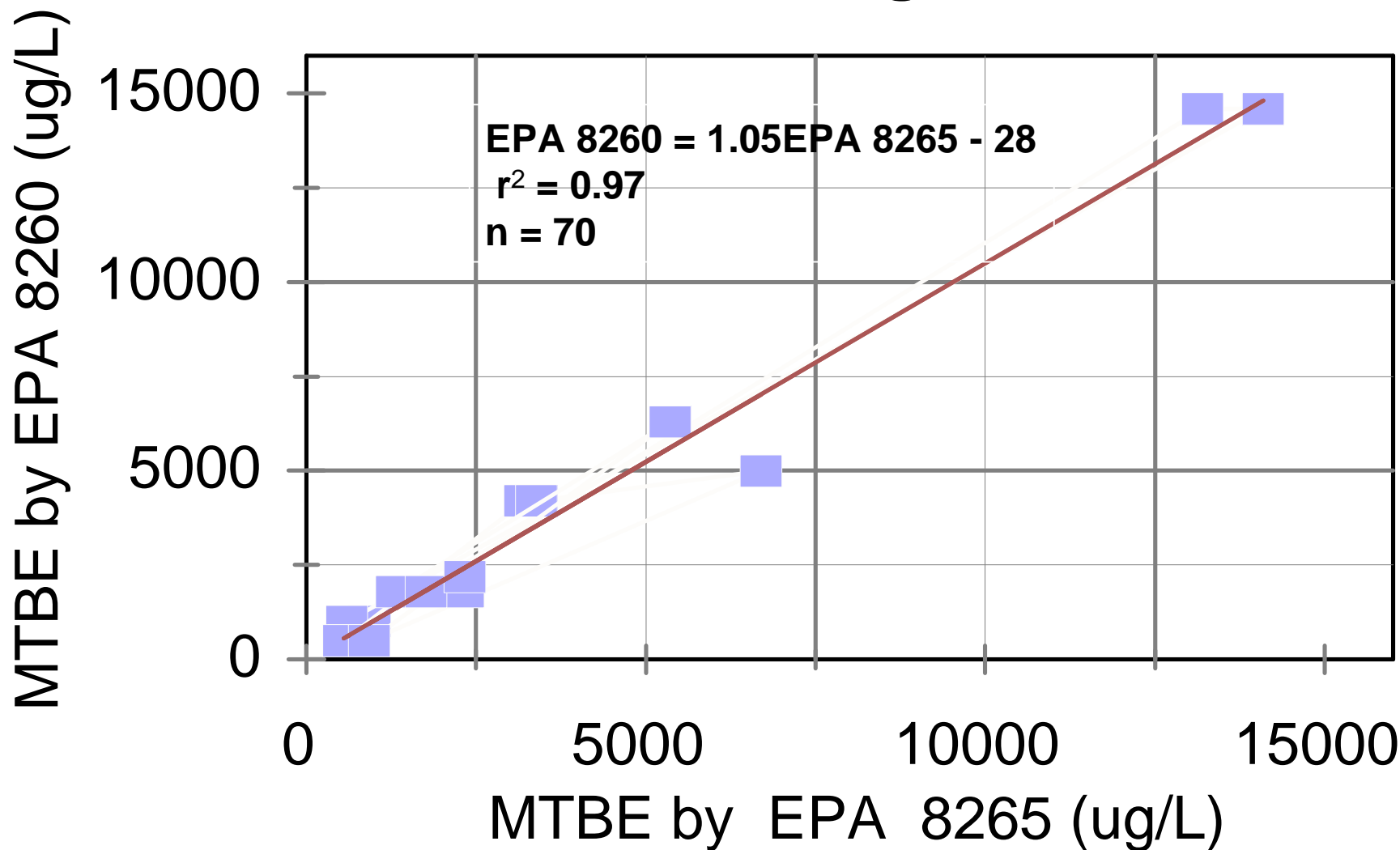


Interference at m/e 73 for MTBE in the presence of petroleum hydrocarbons: 40 ppb false positive for MTBE at m/e 73 in presence of 10 ppm gasoline.

Figure 2. Apparent MTBE in Gasoline Sample



Comparison data for commercial service stations, San Diego, CA



Advantages of DSITMS

- **Very rapid analysis 3 minutes or less**
- **Sensitive with low LOD**
- **Extremely simple sampling interfaces**
- **Very rapid recovery from high level samples**
- **Large amount of quality control (typically 40%)**
- **Near real time data for on site decisions**
- **Supports Triad approach to site characterization**

Disadvantages of DSITMS

- **Isobaric ions reported as analyte pairs**
- **Totally manual operation**

C-17 Hanger Investigation, CSM Field Day 15, 16 May 2003

14 field days

15 MIP penetration

15 Geophysical CPT penetrations

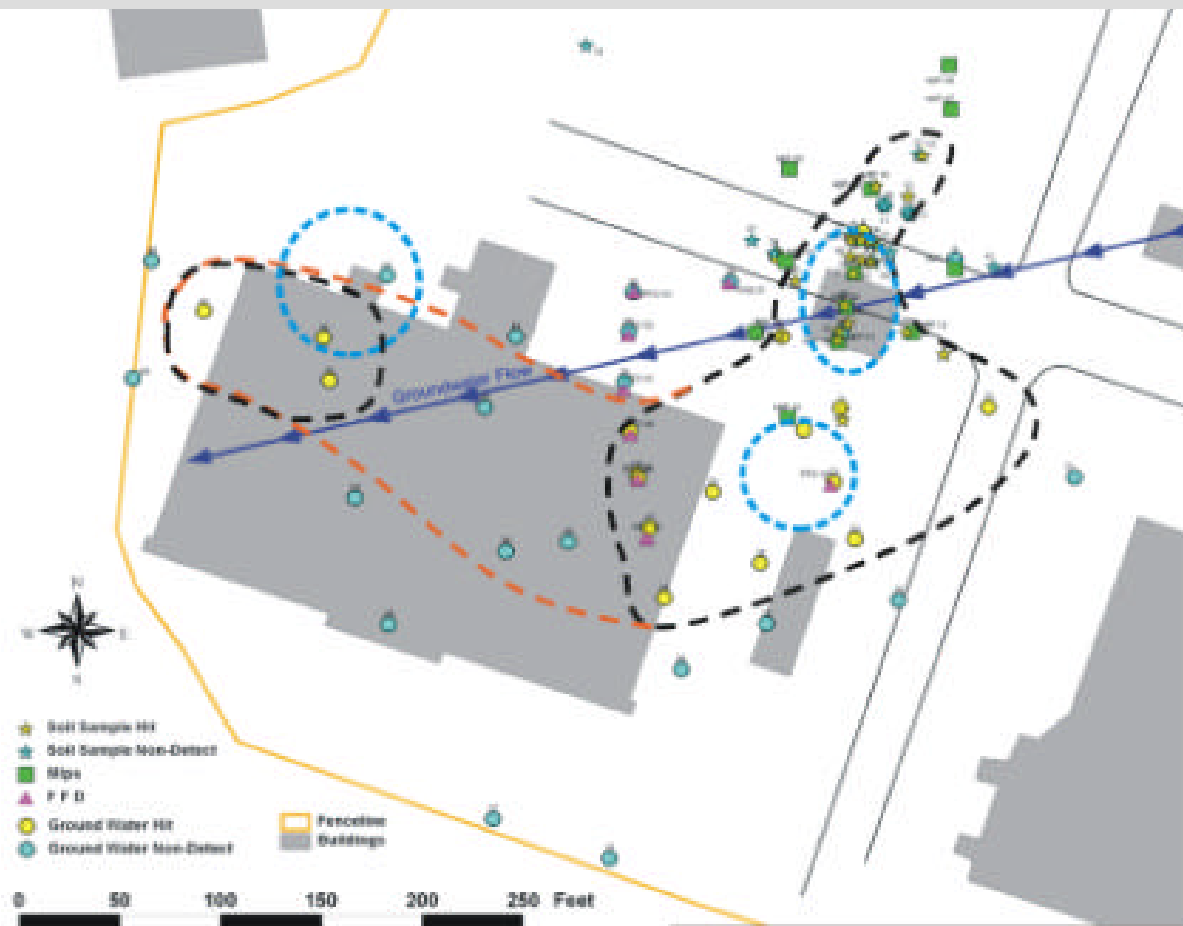
>20 continuous soil core logged

Data collected using DSITMS and EPA Method 8265

33 soil sampling locations, 234 discrete soil analyses

45 GW sampling locations, 162 discrete GW analyses

244 QC analyses



How do you know when enough (data) is enough?

Using the dynamic work plan approach with real-time data addresses the largest site uncertainty: sample representativeness allowing the decision to stop taking data to be made with confidence BEFORE you leave the site.

